Names (pair) _____ Date _____

# Parameters and the Number of Solutions

Example

How many solutions does $x^2 - 4x + m = 0$ have? It depends on the number $m$, which we call a **parameter**. The discriminant is $D = 16 - 4m$.

Two solutions: $16 - 4m > 0$, that is $m < 4$. One solution: $m = 4$ (then $x = 2$). None: $m > 4$.

**1** IN PAIRS Share the work: **student A** does the top three equations and **student B** the bottom three. Work out the discriminant and find for which $m$ the equation has two solutions, one or none. Then check your partner's rows.

| | equation | $D$ | two | one | none |
|---|---|---|---|---|---|
| student A | $x^2 + 6x + m = 0$ | | | | |
| | $x^2 - 2x + m - 3 = 0$ | | | | |
| | $2x^2 + 4x + m = 0$ | | | | |
| student B | $x^2 - 8x + m = 0$ | | | | |
| | $x^2 + 2x - m = 0$ | | | | |
| | $3x^2 - 6x + m + 1 = 0$ | | | | |

**Remember**

For an equation with a parameter: 1) work out $D$ as an expression in the parameter, 2) solve $D > 0$, $D = 0$ and $D < 0$ for the parameter. If the parameter is **in the coefficient of $x^2$**, look separately at the case when that coefficient is $0$: then the equation is not quadratic but linear.

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**2** IN PAIRS A parameter in the coefficient of $x^2$: how many solutions does $(m-1)x^2+4x+2=0$ have?

For $m=1$ : ☐ $\Rightarrow$ $x=$ ☐

For $m\neq 1$ : $D=$ ☐

two solutions: ☐ one: ☐ none: ☐

**3** IN PAIRS For which $m$ does $x^2+mx+9=0$ have two solutions, one or none? Factorise the discriminant and solve with a sign table, as for linear inequalities.

$D=$ ☐ $=$ ☐

| $m$ | $-\infty$ | ☐ | | ☐ | $+\infty$ |
|---|---|---|---|---|---|
| $m-6$ | | | | | |
| $m+6$ | | | | | |
| $D$ | | | | | |

two solutions: ☐ one: ☐

none: ☐

★ ON YOUR OWN **Exit card.** For which $m$ does $x^2-10x+m=0$ have only one solution? What is the solution?